DOCUMENT RESUME

ED 094 463 EA 006 309

AUTHOR Benedict, Larry G.
TITLE Some Applications of the Operationalization of Fuzzy Concepts.
PUB DATE Apr 74
NOTE 16p.; Paper presented at American Educational Research Association Annual Meeting. (59th, Chicago, Illinois, April 15-19, 1974)

EDRS PRICE MF-$0.75 HC-$1.50 PLUS POSTAGE
DESCRIPTORS *Behavioral Objectives; Bibliographies; Curriculum Development; Curriculum Evaluation; *Educational Objectives; *Evaluation; *Measurement; Performance Criteria; Personnel Evaluation; Program Planning
IDENTIFIERS OFC; *Operationalization of Fuzzy Concepts

ABSTRACT

This paper concerns itself with a diverse set of applications of the Operationalization of Fuzzy Concepts (OFC) procedure -- a systematic method for breaking a fuzzy statement of intent, a goal, or a fuzzy concept, into observable, measurable components. The paper assumes that the reader has some prior familiarity with the technique. The publication gives examples of the use of the procedure in curriculum planning, curriculum evaluation, personnel evaluation, and program planning. It emphasizes the area of goals and behavioral objectives, and explores the dichotomous trend in education between Mager, Bloom, Popham, Baker, and McAshan who represent a behavioral objectives school of thought; and Atkin, Ausubel, Raths, Eisner, and others who represent a school of thought somewhat opposed to the behavioral objectives school. The author suggests the OFC procedure as a possible bridge between these two points of view. A short list of references is provided. (Author/DN)

ED 094463

U.S. DEPARTMENT OF HEALTH,
EDUCATION & WELFARE
NATIONAL INSTITUTE OF
EDUCATION
THIS DOCUMENT HAS BEEN REPRODUCED EXACTLY AS RECEIVED FROM THE PERSON OR ORGANIZATION ORIGINATING IT. POINTS OF VIEW OR OPINIONS STATED DO NOT NECESSARILY REPRESENT OFFICIAL NATIONAL INSTITUTE OF EDUCATION POSITION OR POLICY.

SEP 13 1974

Some Applications of The Operationalization of Fuzzy Concepts

Dr. Larry G. Benedict
Student Affairs Research & Evaluation Office
University of Massachusetts at Amherst

April 1974

A Symposium Paper Presented at the Annual Convention of the American Educational Research Association, Chicago

EA 006 309

Introduction

This paper assumes that the reader has some experience or familiarity with the Hutchinson technique known as "The Operationalization of Fuzzy Concepts." If the reader does not have such experience, she or he is encouraged to get that information prior to reading this paper. Otherwise, the applications discussed will not be fully understood. This paper is intended for those readers who have some familiarity with the OFC.

For those persons wishing to experience the process (and Hutchinson has expressed the position that the best way to learn this technique is to experience it, not to have it described), these two references would be most useful:

Coffing, R. T., Hutchinson, T. E., Thomann, J. B. & Allan, R. G. Self-instructional module for learning the Hutchinson method of operationalizing a goal or intent. University of Massachusetts, School of Education, June 1971, mimeo.

Brooks, J. B., Hutchinson, T. E., Benedict, L. G. & Coffing, R. T. Specifying Meaningful Objectives from Goals: The operationalization of fuzzy concepts. Amherst, Mass: National Evaluation Systems, Inc. 1974. (This is an expanded, revised and updated self-instructional module and workbook.)

After all these years, there is still a dichotomous trend in education regarding behavioral objectives. On the one hand there are Mager (1962), Bloom (1956), Popham (1969), McAshan (1970), and Popham and Baker (1970), all of whom represent a school of thought which would have us detail in behavioral terms the objectives of whatever it is we are about; or, they pose, we'll never know where we are going or where we have been. On the other hand there are a number of spokesmen like Atkin (1963), Ausabel (1967), Raths (1968), and Eisner (1969) who question the efficacy of the former school, suggesting that when forced to operate along "Magerian" lines, the essence of what we are about may very well be lost. They might also argue that the behavioral objectives approach is limited in its ability to deal with things that really are, or should be, of concern and importance to us, e.g., affective goals. Despite Popham's (1968) excellent refutation of this latter point of view, an uneasiness still remains with us about the efficacy and desirability of one or the other of these two seemingly polar-opposite points of view.

These two positions may not be polar opposites. The problem may be that our abilities of conceptualizing have been in too immature a state to handle the "non-Magerian" versus the "Magerian" points of view simultaneously. The point is:

> Evaluators, educators, all human beings, have enormous difficulties in reporting the sum and sweep of their objectives. We all have goals, and we consciously and unconsciously give priority to some goals over others. But we have few reliable ways to report them to others, or even to reveal them to ourselves (Stake and Denny, 1969, pp. 375-376).

This is the crux of the matter. We all have goals, but getting from goals to verbalized or explicit statements of what these goals mean not only to others but to ourselves is the problem.

For example, it is easy to state, "The student shall solve five quadratic equations in five minutes without the use of any materials other than scrap paper and a pencil." It is easy to communicate this to others with full understanding, as it is an easy task to determine whether, if and when this objective is accomplished by the learner. However, this is not the case with a whole host of other kinds of goals, e.g., affective: "The student shall be self-actualizing..." or "The student shall value his self," and so on. These latter goals are difficult to communicate and understand; and yet, a legitimate argument can and is made that these are as important as solving five quadratic equations. While verbalizing these humanistic or affective goals, teachers and educators and objectives-writers have failed to deal effectively with them, precisely because their conceptualizing abilities have not been advanced enough nor comprehensive enough to do so. What is the solution? Can there be one? Is it true that without "Magerian" objectives we cannot progress anywhere? Is it true, as the "non-Magerians" state, that putting content or goals into "Magerian" terms destroys that which is to be measured?

To date our conceptualizing strategies have been limited. A possible bridge from the Mager to the Atkin position, i.e., a possible solution to this dilemma, may have been developed by Hutchinson (1969a, 1969b)--perhaps quite accidentally while working on solutions to other problems. He may have come up with a process whereby both the Magerians and their opposition will feel not only comfortable with what they are doing, but with each other. They need not seem to be polar opposites any longer, nor mutually exclusive, since in reality (it is contended) they are simply different points on a single continuum.

Examine for a moment some of the beginning of this controversy. Why is it that objectives ever began? It could have started when evaluation or assessment of student achievement began. It really came into focus with programmed learning with which Mager was really concerned when he wrote his book. The problem actually had its basis in the need for measurement. And this is the point at which evaluators entered the scene.

Evaluators and evaluations have had and continue to have a bad name. They are associated with anxiety on both the teachers' and students' parts. They have too often been part of the first school of thought mentioned earlier: "Tell me your specific behavioral objectives and then I will evaluate" is typically assigned as coming from an evaluator. As Stake and Denny write (1969),

> An evaluator's technical skill should help the educator convey his purposes, both those that quickly come to mind and those implicit in what he does. What are the present methods.... Our methods now are crude, unstandardized and unvalidated. They should be more evocative, more sensitive than indicated by the bold request, 'Please state your objectives in the following space'" (p. 376).

However, the above is not the only shortcoming of evaluators. A second is that of the subjective approach to evaluation, all too common a practice today. In this method of evaluation, the evaluator enters the situation and "feels" what is happening, or tries to sense some sort of global dimensions of what's happening, after which the evaluation is written. The problems with this approach are all too obvious.

Yet a third dimension which contributes to the fear and anxiety associated with evaluations is that the evaluator will use outside,

unknown or irrelevant criteria to evaluate "my school" or "my course" or "ME." That this point has been compromised is evidenced, for example, by such criteria for a Social Studies Evaluation, as provided in the Natural Study of Secondary School Evaluation's, Evaluative Criteria (1960) as: enrollment, number of sections, range of class size, class periods per week, room arrangement and so on.

These problems with the current state of evaluations need not be the case. In fact, the whole nature of evaluation, what it is and isn't, what it should and shouldn't do is changing (Stake (1967), Stufflebeam (1969), Scriven (1967). Evaluation has been newly defined by some as providing data for decision making.

It is in this redefinition of the function of evaluation, and in developing a much-needed methodology of evaluation consistent with this movement that Hutchinson has devised a procedure he has entitled "The Operationalization of Fuzzy Concepts." An initial reaction to such a title is probably scepticism followed by "What is it?" Upon investigating this procedure, one discovers an extremely wide range of potential possibilities and applications. One such application is dealing with educational goals that are not easily turned into behavioral objectives, educational goals which are usually fuzzy concepts.

What is a Fuzzy Concept?

Fuzzy concepts are common. We all use them everyday of our lives in communicating: peace, love, democracy, patriotism and civil liberties are just a few examples of some of the many, many fuzzies used frequently today. Because each of us has different perceptions of the same words, such as those above, or phrases like self-actual ization, individualizing instruction and student-centered learning

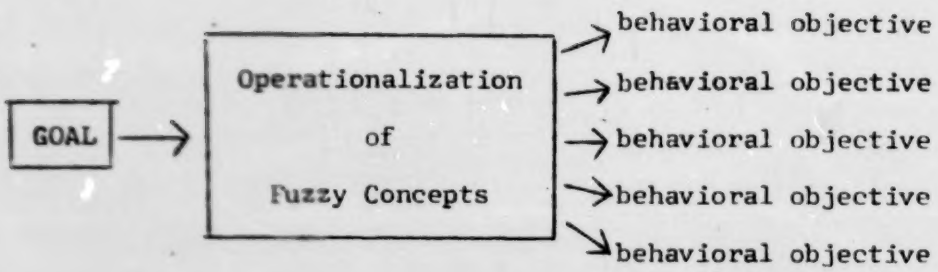
there often arises misunderstanding, disagreement, tension and even conflict. Often one hears the point made that what is really at issue is a semantic problem, a communication gap. This is due in part to the use of fuzzy concepts.

Fuzzy concepts can also be said to represent the dichotomy between instructional or behavioral objectives and goals, or non-instructional objectives. This very important difference or differentiation between goal and objective should not be underemphasized, overlooked nor confused. A goal, for example, is an "end" in non-behaviorally defined terms, such as "The student shall be self-actualizing." An instructional or behavioral objective on the other hand is an operationalized goal, e.g. "The student shall list in writing his own reading list of at least five books in this course in Learning Psychology."

The apparent gap between the two schools of thought on the objectives controversy, between "goals" and "behavioral objectives," is due in part to the fact that in reality these represent two different points on a single continuum, not two different continua. All of us have goals; no one would deny this. It is simply a lack of conceptualizing strategies, an absence of a means by which to show that this gap between "goals" and behavioral objectives" is only an apparent gap that is the issue in this controversy.

Hutchinson's technique, the Operationalization of Fuzzy Concepts, may be the conceptual tool needed to resolve the issue. Keeping in mind the definition of a goal as a non-operational statement of intent, this might be represented as shown in Figure I.

FIGURE I



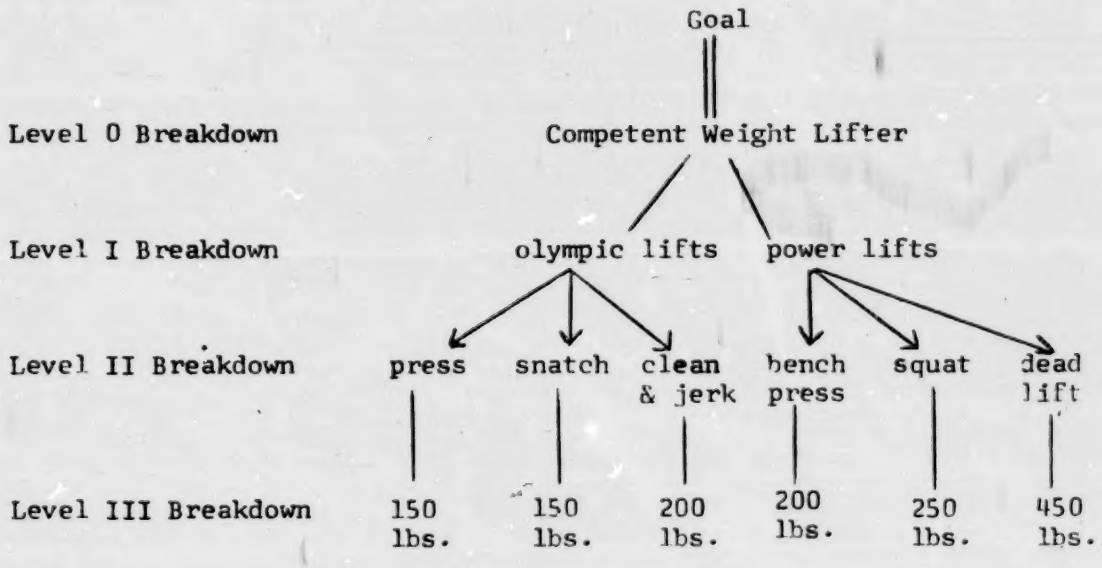
A goal, when the operationalization technique is applied, will (probably) yield many behavioral statements of intent which then can be turned into behavioral objectives. Let's look at an example of how this might work using a fuzzy concept which isn't too fuzzy (i.e., one which can be fully operationalized in several levels rather than a large number). A fuzzy concept for a college physical education teacher might be "competent weight lifter." At the first level of breakdown, there are two dimensions: olympic lifts and power lifts. Asking the question, are these measurable or observable directly, the answer is "no" and the process is continued.

At the second level of breakdown, six more components are found, three from each of the first two: press, snatch, clean and jerk; and bench press, squat and dead lift. Further operationalizing "competent," certain attributes are attached to these dimensions, thus the third level of breakdown:

For a weight lifter with a body weight of 123½ pounds or less,
press: 150 lbs.
snatch: 150 lbs.
clean and jerk: 200 lbs.
bench press: 200 lbs.
squat: 250 lbs.
dead lift: 450 lbs.

FIGURE II

Example of An Operationalized Goal



Each of these components can be observed or measured by numerous methods and thus are no longer fuzzy. (The lifts themselves are operationalized by the current A.A.V. Weightlifting Handbook.) These operationalized components then become the basis for writing objectives: for example, "The student shall press 150 lbs."

This was obviously a simplistic fuzzy concept with appeal to a limited audience. However, it exhibits how the process can and does work. The objectives for this particular course were systematically generated from a goal statement, using the OFC technique.

It is important therefore not to dismiss goals, just as it is important not to dismiss objectives. The premise here is still the use of objectives, or operationalized goals. What is important is the way or means by which teachers and other educational decision-makers are exposed to and introduced to the logic and necessity of objectives, as well as the way in which evaluators go about arriving at behavioral objectives.

Curriculum Planning

The weightlifting example provides us with an introduction to how the OFC technique might be used for curriculum planning or curriculum development. One of the most logical and systematic models for curriculum development was first offered by Ralph Tyler (1950) more than twenty years ago. Despite the time which has elapsed since then, his model is still one of the best available. In Tyler's Model, the curriculum developer starts with goals, broad statements of intents, or aspirations. Tyler suggests that such statements can be found in a number of sources: the Learner, Society, the Subject Matter, the

Teacher, etc.* Tyler would then have the developer determine or identify the objectives for the course. While we know that there is a relationship of objectives to goals, Tyler does not offer a systematic process for going from goals to objectives. Hutchinson's OFC process, a proven technique for systematically generating objectives from goals, is applicable. In fact, it has been used by some teachers to develop learning modules, or units of instruction.

Curriculum Evaluation

Once measurable or observable objectives have been identified (and if the OFC technique is applied appropriately, one has such objectives) then it becomes a relatively simple matter to design measurement techniques or to choose some data collection device. The statement which one uses to base one's teaching, e.g. "To press 150 lbs. at the end of the semester, is then used as a basis for measuring achievement; either the student can or can't press 150 lbs.

What about the situation where someone wants to evaluate a project or undertaking for which goals had never been systematically identified? How would one evaluate the project or enterprise in such a situation? It would first be necessary to identify the goals which the project was in fact working to achieve.* This would be done after the fact, something less than the ideal. The OFC technique would then be applied to these goals and the result would be the same as if this had occurred at the beginning of the project's planning stage: statements of operational intent or objectives. Again, once these are

*A detailed methodology to identify a set of goals for any given enterprise, undertaking, course, etc. can be found in: Benedict (1973). This methodology can be used within the framework of the Tyler Model for Curriculum Development. It also can be applied in any situation where one wants to identify a relatively complete set of goals.

identified, it is simply a matter of designing measurement techniques or choosing data collection devices.

Personnel Evaluation

The OFC can be used to evaluate personnel much in the same way it was used to evaluate curriculum. Most personnel have a defined task or set of tasks to do. This may take the form of a job description, or job specifications or just a general assignment. Using the basic procedure discussed above, the goals for a given person are identified. There are a number of ways in which this can be done, and it is not the purpose of this paper to describe such procedures. Once the particular goals a person is supposed to achieve have been identified, those goals are operationalized. This also can be done in a variety of ways: by the employee himself, by the supervisor herself, by the two of them interacting, and so on. The specific procedure will vary from institution to institution. Once the goals have been operationalized and agreed upon by employee-employer, they form the basis both for job performance and for job evaluation. The same measurement arguments used for educational behavioral objectives, especially the criterion referenced argument, can also apply to personnel evaluation. (It is beyond the scope of this paper to fully explore this concept. Suffice it to say that the OFC can be applied in personnel evaluation, it can be used by employers to define jobs and then to generate criteria by which to hire someone. In fact, the Student Affairs Division of the University of Massachusetts is at least beginning to move in this direction.)

These three sections have presented a logical procedure for planning curriculum, evaluating such curriculum, and providing a basis for personnel evaluation. Basically that procedure calls for identifying the goals which the project or person are to achieve and then operationalizing those goals. The results of operationalizing are used in one instance to write objectives which then form the basis for choosing learning activities or planning instructional tasks. In the other situation, the results of operationalizing are used to assess whether the objectives have been met.

This procedure can be generalized to other situations, and it is through such generalizations that other applications of the OFC procedure can be viewed. Whenever one has a goal, however fuzzy, one can begin to operationalize it using the OFC process.

The following examples are taken from the many applications of the OFC technique over the last several years.

1. A doctoral student used it in planning his program of study, operationalizing his goals for getting his degree and then using the results to select courses, learning opportunities, etc.
2. A Federal Agency used the OFC to identify a range of criteria which were then used to screen in-coming proposals in order to determine if the proposal met the intentions of the funding agency. Instead of trying to fund "basic educational programs" the agency had a list of 20 or 30 operational criteria.
3. A teacher used it to develop a set of test items.
4. Dozens of teachers have used it in the evaluation process, ranging from pre-school summer programs through Title III

programs and even for an Alternative School, which used the process for both planning and evaluation.

5. In a hypothetical situation, it was used to develop criteria to hire new teachers.
6. Student teachers used it to plan their student teaching experience, to do their lesson plans and so on.

Most of the situations where the author is aware that the OFC has been used are in educational situations, elementary through college. However, it is reasonable to expect that is has had wider application than simply educational settings. To conclude this section, one additional example might be illustrative: an enthusiastic auction-goer helped the auctioneer operationalize his main goals for his auctions, e.g. the actual selling price of an item should not fluctuate $10 above or below catalog price. (The enthusiast then sat in the audience and recorded each sale and determined for each item if the objective had been met and then reported this data back to the auctioneer.) The point is that the OFC has a very wide range of application, subject only to the needs and desires of the person wanting to operationalize. The reader is encouraged to consider additional applications.

REFERENCES

Atkin, Myron. "Some Evaluation Problems in a Course Content Improvement Project," J Res Sci Ed, Vol. 1, (1963), pp. 129-132.

Ausabel, David P. "Crucial Psychological Issues in the Objectives, Organization, and Evaluation of Curriculum Reform Movements," Psychology in the Schools, Vol. IV, No. 2 (April 1967), pp. 111-121.

Benedict, L. G. The Goals Process in the Fortune/Hutchinson Evaluation Methodology: A Handbook (xerox), University of Massachusetts, Center for Educational Research, April 1973.

Bloom, Benjamin (ed.) Taxonomy of Educational Objectives I: Cognitive Domain. New York: Longmans, Green, 1956.

Eisner, Eliot. "Instructional and Expressive Objectives: Their Formulation and Use in Curriculum," in Instructional Objectives, AERA Monograph Series, No. 3. Chicago: Rand McNally, 1969.

Hutchinson, Thomas E. "A Numerical Example of Centaur Analysis among Flexibly Determined Subgroups", American Educational Research Journal, Vol. 6, No. 1, 1969a.

_____. Level of Aspiration and Statistical Models Applicable to the Problem of Refining Choice Bases for Career Development: Logic with Implications, (unpublished doctoral dissertation,) (Xerox) Harvard Graduate School of Education, 1969b.

Mager, Robert. Preparing Instructional Objectives. Palo Alto: Fearon, 1962.

McAshan, H. H. Writing Behavioral Objectives: A New Approach. New York: Harper & Row, 1970.

National Study of Secondary School Evaluation: Evaluative Criteria. Washington, D.C.: The Society, 1960.

Popham, W. J. "Probing the Validity of Arguments Against Behavioral Goals," A Symposium Presented at AERA, Chicago, February 1968.

_____. "Objectives and Instruction," in Instructional Objectives, AERA Monograph Series, No. 3. Chicago: Rand McNally, 1969.

_____, and E. Baker. Establishing Instructional Goals. Englewood Cliffs, N.J.: Prentice-Hall, 1970.

Raths, James D. "Specificity as a Threat to Curriculum Reform," A paper presented at AERA, Chicago, February 1968.

Scriven, Michael. "The Methodology of Evaluation," in Perspectives on Curriculum Evaluation, AERA Monograph Series, No. 1. Chicago: Rand McNally, 1967.

Stake, Robert. "The Countenance of Educational Evaluation," Teach Coll Rec, Vol. 68, (1967), pp. 523-540.

_____, and Terry Denny. "Needed Concepts and Techniques for Utilizing More Fully the Potential of Evaluation," in Educational Evaluation: New Roles, New Means, NSSE Yearbook, Part II, 1969, pp. 370-390.

Stufflebeam, Daniel. "Evaluation as Enlightenment for Decision Making," in Improving Educational Assessment. Association for Supervision and Curriculum Development, NEA, Washington, D.C. 1969, pp. 41-73.

Tyler, R. W. Basic Principles of Curriculum and Instruction. Chicago, Illinois: University of Chicago Press, 1950.